



# **Demonstration/Validation of High Performance Corrosion Preventive Compound For Interior Aircraft Applications**

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# What is it?



## Problem

**Existing CPC products require reapplication every 6 - 9 months, which results in an increase in the cost due to air pollution, maintenance, labor, down time, and the number of inspections.**



# Objectives



- **Demonstrate/validate a newly developed high performance corrosion preventive compound (Navguard) on fleet aircraft and weapon systems.**
- **Demonstrate long-term protection to reduce environmental pollution caused by HAPs and VOCs and corrosion maintenance.**



## Why are we doing it?



- **Reduce environmental pollution caused by HAPs (Hazardous Air Pollutants) and VOCs (Volatile Organic Compounds)**
- **Improve the fleet readiness through the following:**
  - **Extend maintenance inspection intervals**
  - **Reduce the number of CPC applications**
- **Reduce waste and disposal costs**



## Regulatory Impact to the Navy

<u>Requirements</u>	<u>Priority</u>	<u>Requirement Title</u>
2.I.01.q	High	Control of VOC and HAP Emissions
3.II.03.a	High	Non-VOC/ODS Solvents and Cleaning Systems for Aircraft/Weapon systems
2.1.01.g	High	Control/Reduce Emissions from Cleaning, Stripping, and Cleaning Operations.



# Deliverables



- **New high-performance, long-lasting (two years) CPC product (Navguard) for internal airframe applications**
- **Complete field test evaluation on several Army, Navy, and Marine Corps aircraft in various operational environments**
- **A new qualified product to MIL-PRF-81309 F specification for internal aircraft applications**
- **Recommend changes to aircraft Maintenance Manuals and Maintenance Requirement Cards (MRC)**
- **Final report**



## Who is Involved?

- **Testing Sites**

- NAVAIR, PAX River, MD
- FRC, Cherry Point, NC (H-46)
- FRC, North Island, CA (F-18)
- NAS, Oceana, VA (F-18)
- NAS, Whidbey Island, WA (EA-6B)
- US Marine, Camp Pendleton, CA (EFV)
- Army Aviation, Ft. Rucker, AL (H-60)

- **Funding Agents**

- ESTCP , OSD Corrosion IPT, AERMIP (Aircraft Reliability and Maintainability Improvement Program)



## Properties of Navguard Product

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- **Foggable (by aerosolizing nozzle)**
- **Low VOC content**
- **Compatible with metal and non-metallic components**
- **Water displacing agent**
- **Corrosion inhibition of aluminum and steel alloys**
- **Reapplication does not add significant weight to aircraft**
- **Exhibits significant improvement upon corrosion inspections**



# CPC Formulation



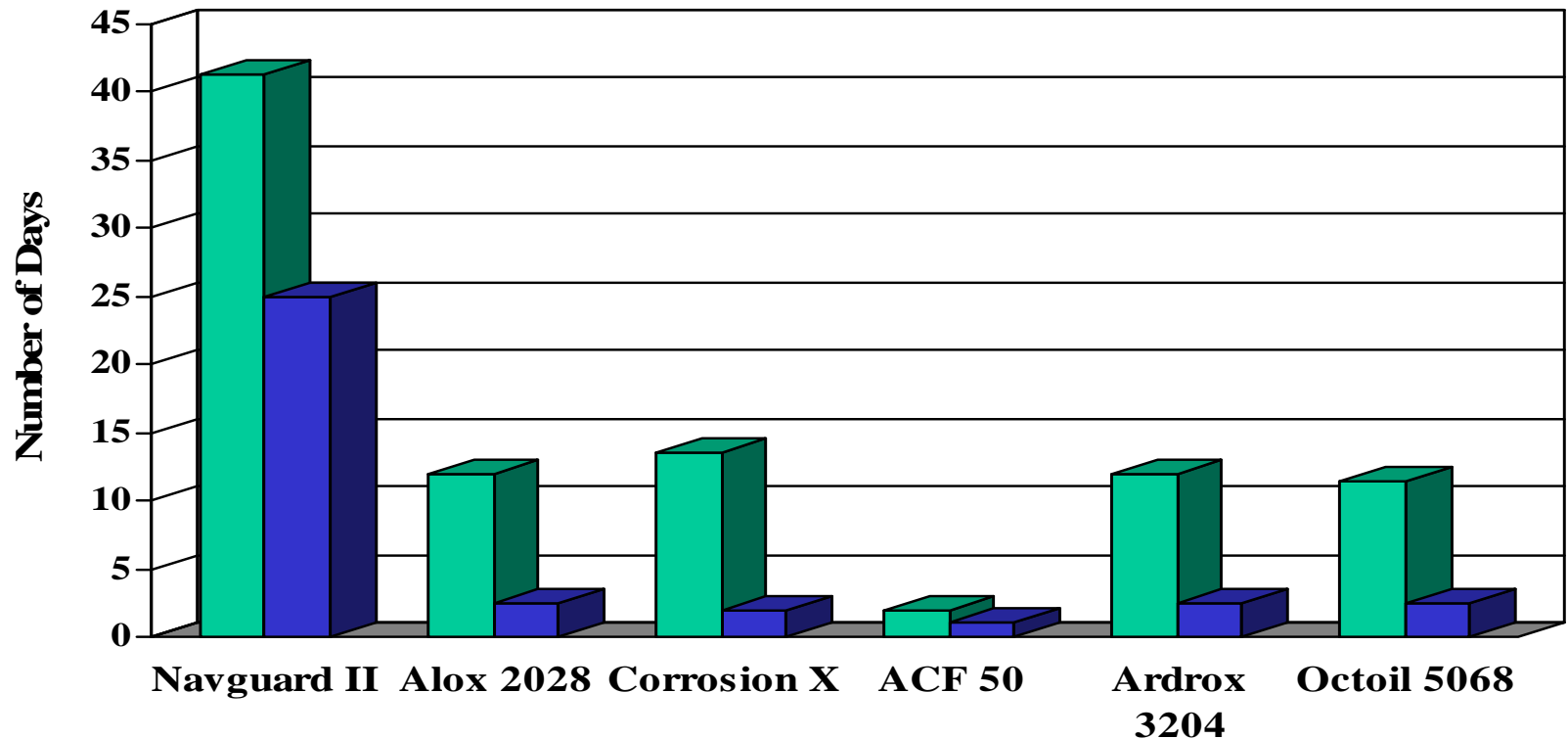
## Navguard Formulation

(Patent Pending, Navy Case 95904)

- ▶ Corrosion Inhibitors
- ▶ Oil (Paraffinic or Naphthenic)
- ▶ Solvents
- ▶ Water Displacing Agent
- ▶ Metal Deactivator Agent
- ▶ Antioxidant



# Neutral Salt Spray Test Results for Navguard compared to Commercial CPC Products



**New CPC Formulations and Control**

■ Aluminum ■ Steel



# Navguard Type II and Type III (Armick Chemical)





# Field Test for Navguard on Expeditionary Fighting Vehicle (EFV), Camp Pendleton, CA





# Expeditionary Fighting Vehicle (EFV-E4), Camp Pendleton, CA (U.S. Marine – General Dynamics)





# E-7 Port For EFV Without Parker Seal and Cover

NAV  AIR





# New Parker Seal with Navguard Installed in EFV

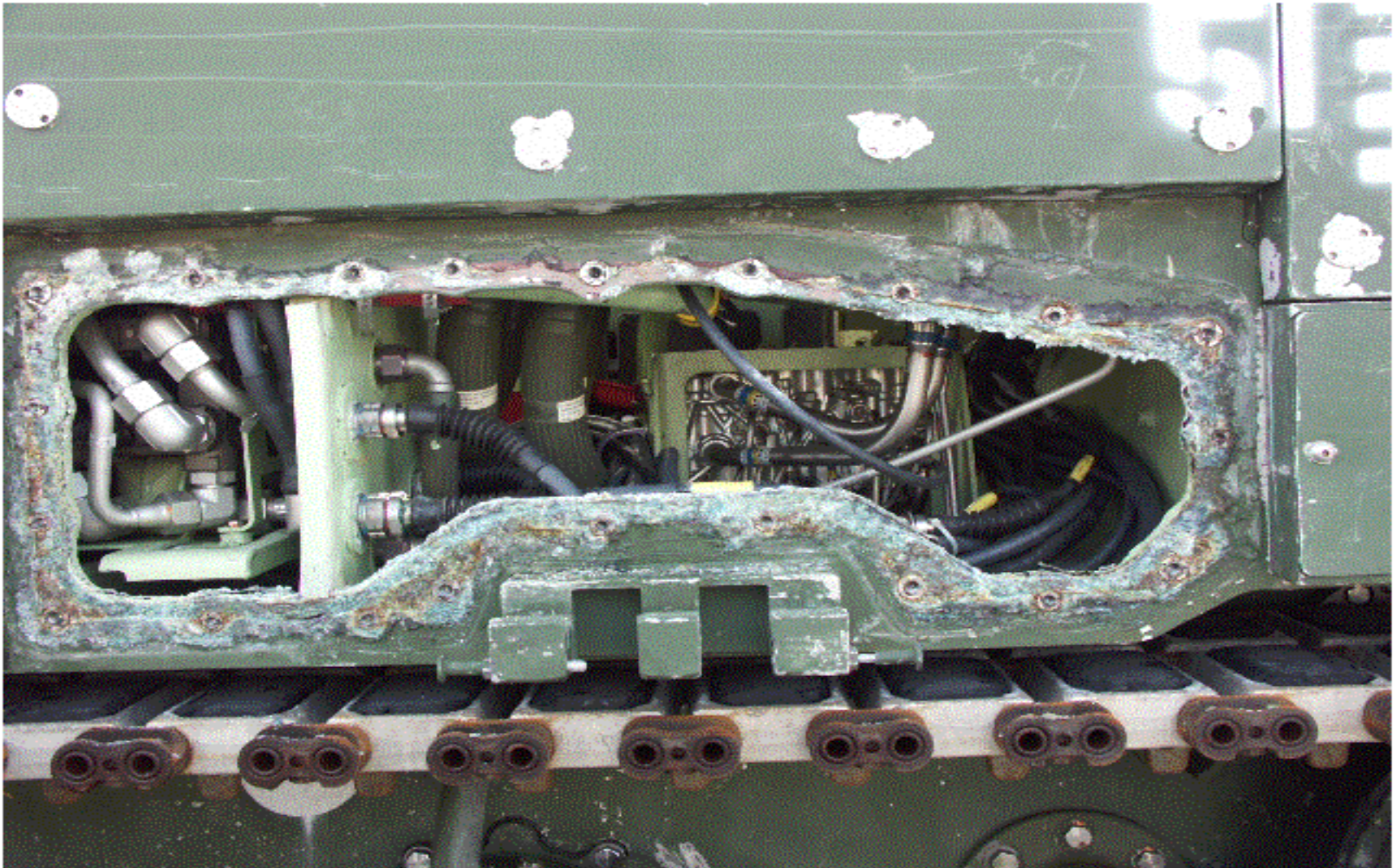
NAV  AIR





## Corroded Port Panel Frame with Defected Seal, EFV E-7

NAV  AIR





## Panel Frame After Six Months With and Without Navguard CPC, EFV E-7



Without Navguard



With Navguard





# Field Test for Navguard on F-18/B, NAS Oceana, Norfolk, VA

NAV  AIR





# Door #3, Field Test on F-18/B Aircraft (Twenty-Four Months Exposure)





# Navguard Application on F-18/B Compartment After Twenty-Four Months



After 24 Months



Initial Application





# Summary of the Dem/Val of Navguard CPC on Different Platforms



Location	# Aircraft	Type of Aircraft	Schedule
FRC, North Island, CA	5	F-18	Started June 2007
NAS Oceana, VA	12	F- 18	Started May 2007
FRC, Cherry Point, NC	4	H-46	Started January 2007
NAS Whidbey Island, WA	5	EA-6B	Started May 2007
AMCOM, Red Stone, AL	1	H-60	Started September 2007
US Marine Corps, Camp Pendleton, CA	8 Units	EFV	Started November 2006



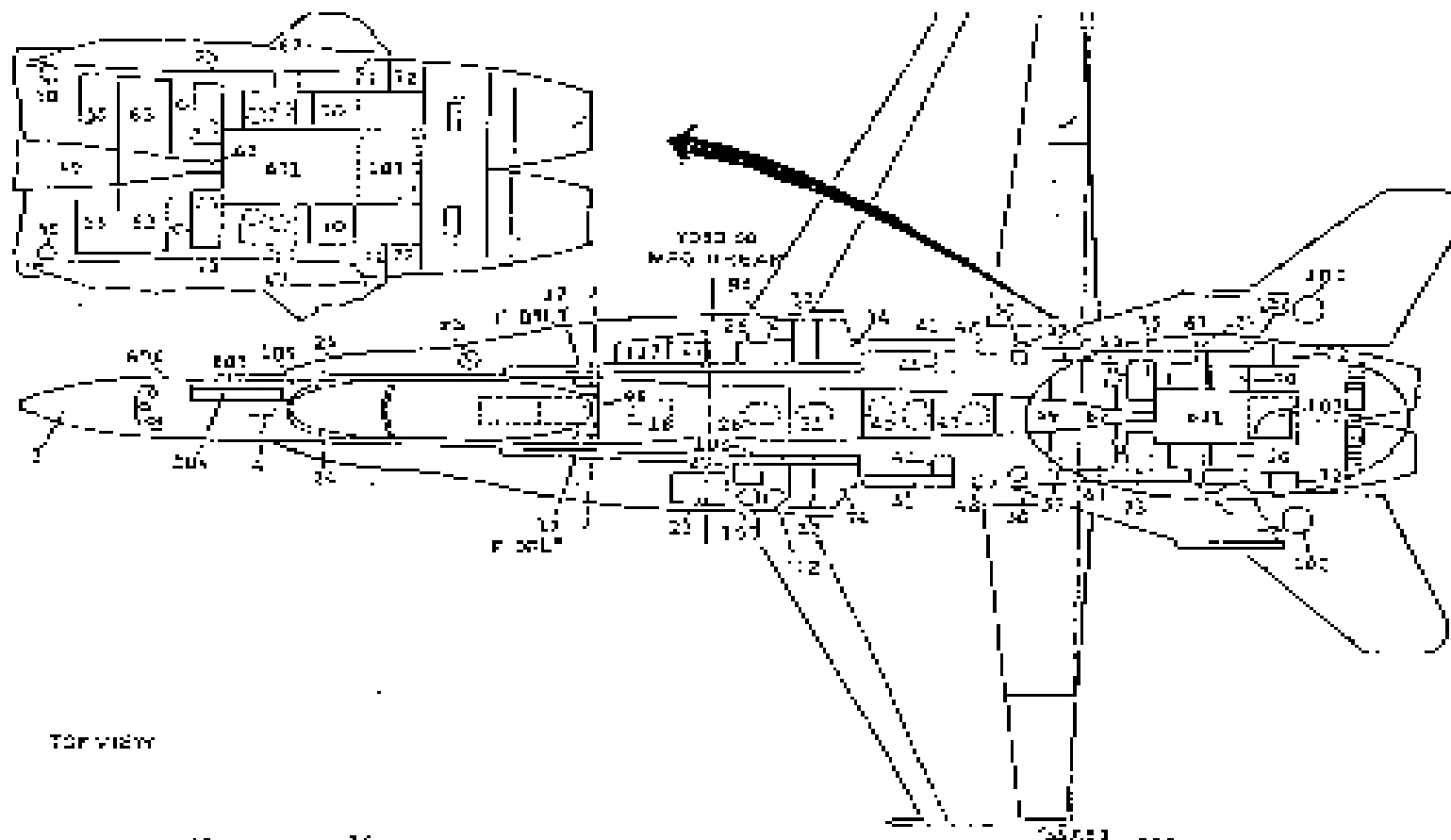
# Demonstration Design



<b>All Panels/Compartments will be the same per TMS</b>	<b>Aircraft #1</b> TMS    BUNO	<b>Aircraft #2</b> TMS    BUNO	<b>Aircraft #3</b> TMS    BUNO
<b>General Access Panel #1</b> Panel ID TBD	Control 81309 Type II	NAV GUARD Type III	NAV GUARD Type II
<b>General Access Panel #2</b> Panel ID TBD	NAV GUARD Type II	Control 81309 Type II	NAV GUARD Type III
<b>General Access Panel #3</b> Panel ID TBD	NAV GUARD Type III	NAV GUARD Type II	Control 81309 Type II
<b>Avionics Compartment #1</b> Panel ID TBD	Control 81309 Type III	NAV GUARD Type III	Control 81309 Type III
<b>Avionics Compartment #2</b> Panel ID TBD	NAV GUARD Type III	Control 81309 Type III	NAV GUARD Type III



# Application of Navguard on F-18 Platform, NI, CA





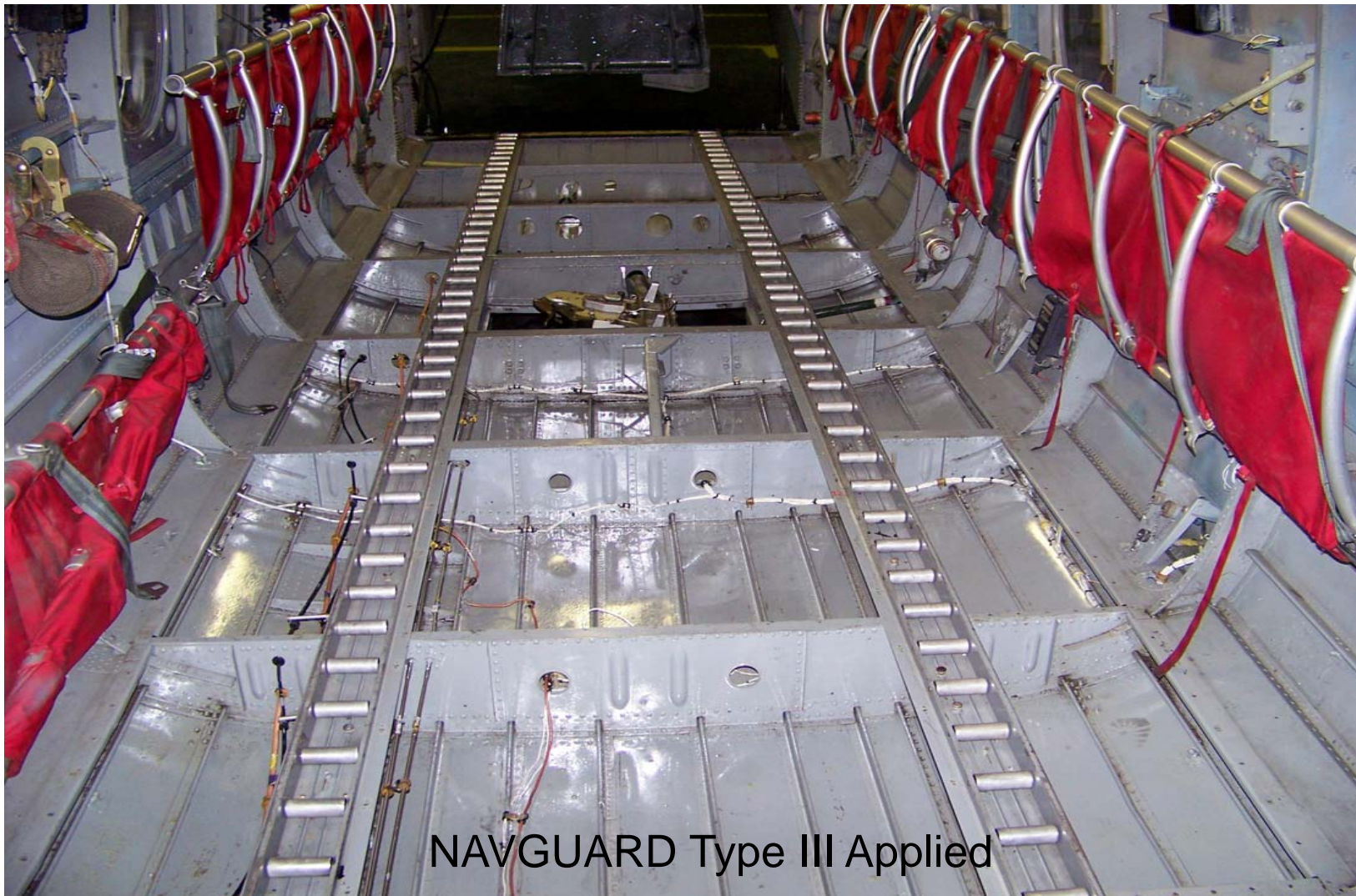
# Application of Navguard CPC on H-46, FRC, Cherry Point, NC, January, 2007



H-46



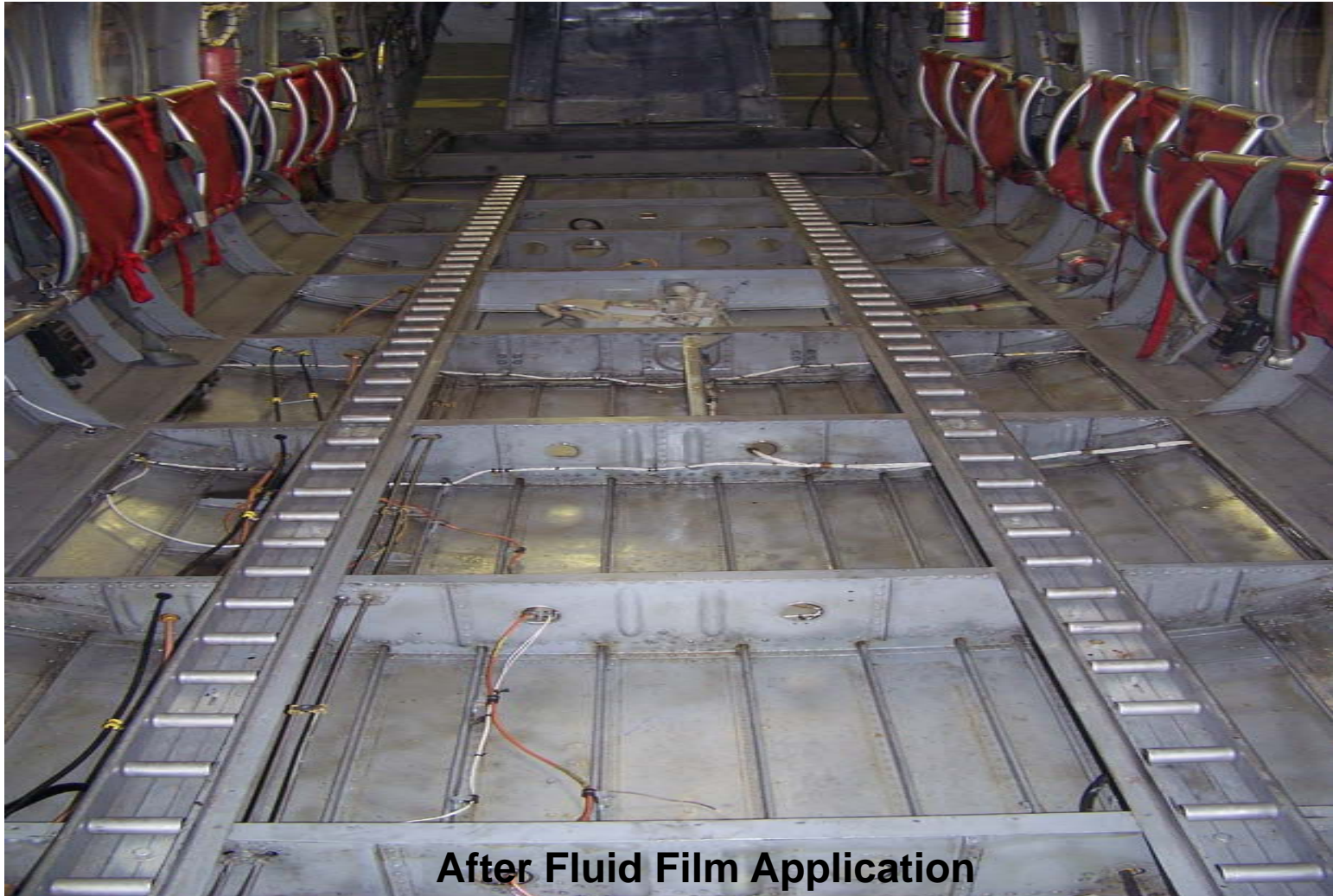
# Navguard Type III Applied on the Bilge Areas, H-46, FRC, Cherry Point, NC



NAV GUARD Type III Applied



# Fluid Film (Control) Applied as Control on H-46, FRC, Cherry Point, NC



**After Fluid Film Application**



# Navguard CPC with Mildew Inhibitor Additives

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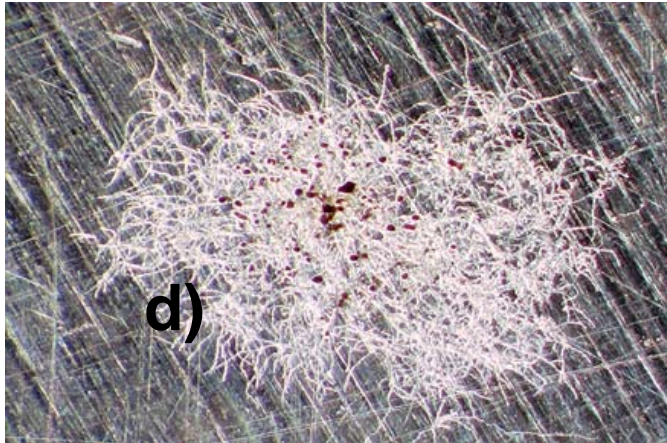


## **A Laboratory Evaluation of Corrosion Preventive Compounds and Mildew Inhibitors in the Presence of Fungi**

Richard I. Ray and Brenda J. Little  
Naval Research Laboratory  
Stennis Space Center, MS 39529

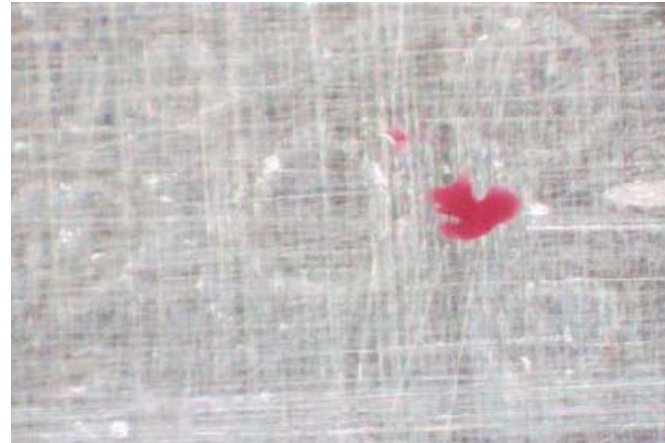


# Navguard CPC with Mildew Inhibitor Additives



**AI Panel/hydraulic Fluid  
Only/Fungi 50X**

**(35 Days)**



**AI Panel/Navguard with  
Mildew Inhibitor/Fungi 50X**

**(100 Days)**

[illegible]



## Transition Plan

- **Stakeholders approval of the new technology**
- **Evaluate the scaled-up product (Navguard) to MIL-PRF-81309F Specification requirements to be included in the QPL**
- **Dem/Val of the new technology on different platforms at several testing sites**
- **Assign a National Stock Number (NSN) to be listed with the DLA**
- **Issue NAVAIR (AF/AMCOM/ other) authorization letter to implement changes to the Cleaning and Corrosion Control Manual (NAVAIR 01-1A-509) and other applicable documents**



# Accomplishments



- 1- Licensing Navguard to Commercial Vendors**
- 2- Navguard Patent Application to US Patent Office**
- 3- Lead-the-fleet demonstrations for Navguard on F-18 and EFV**
- 4- Applying Navguard on Weapon systems (H-46, F-18, EA-6B, H-60, and EFV)**
- 5- Stakeholders Approval of Navguard for Dem/Val Plan**
- 6- Qualification of Navguard to MIL-PRF-81309F Specification**



## Expected DoD Benefits

- 1. Corrosion preventive compound CPC with potentially 2 to 3 times greater corrosion resistance**
- 2. Reduce maintenance and corrosion repair cost**
- 3. Decrease aircraft and other weapon systems down time due to fewer scheduled maintenance and inspection**
- 4. Reduce environmental pollution caused by HAPs and VOCs**
- 5. Reduce waste and disposal costs**
- 6. Increase aircraft/vehicle availability**



## Project Performers

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